

**PATENT**

Attorney Docket No.: den003 nf (2097/5)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): Maurice Moshe ERNST, et al.	Examiner: Eric RUSH (571) 270-3017
Serial No. 12/665,747	Group Art Unit: 2667
Filed: Dec. 21, 2009	Confirmation No.: 3550
For: Supplemental Scene Reference Surface Devices for Three-Dimensional Mapping	Customer Number: 39661

**AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION**

Commissioner for Patents  
Mail Stop AF  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This paper is submitted in response to the Final Office Action mailed May 6, 2015.

Please amend the patent application as follows.

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks/Arguments** begin on page 8 of this paper.

Yours sincerely,

/Maurice Ernst/

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# **AMENDMENTS TO THE CLAIMS:**

Amendments to the Claims are made such that additions are underlined (\_\_\_\_), while deletions are in the strikethrough format, or double bracketed ([[ ]]) where strikethrough format would not adequately show the deletion.

This listing of claims will replace all prior versions and listings of claims in the application. The current status of claims 1-62 is as follows:

1. -36. (Cancelled)

37. (Currently Amended) A reference surface device for use with imaging of an intra-oral scene, the reference surface device comprising:

a) at least one sector including a length defining a first end of said at least one sector, a plurality of faces, and some each face of said plurality of faces are distributed in position and in at an angular orientation on with respect to each adjacent face, the plurality of faces extending along the length of the at least one sector, the at least one sector including oppositely disposed edges which extend from the edges of the outermost faces to a second end of said at least one sector, and wherein said plurality of faces is configured to provide at least one fully intraoral reference surface operative to provide an identifiable positional characteristic; and,

b) a mounting element ~~attached to~~ in communication with said ~~reference device~~ second end of said at least one sector, wherein said identifiable positional characteristic is at a predetermined three-dimensional spatial position from a mounting point adapted to be attached to a feature having a substantially fixed location relative to said intra-oral scene, said intra-oral scene being configured to provide information for determining the three-dimensional spatial position and orientation of a face on said device relative to the intra-oral scene.

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38. (Currently Amended) A reference surface device according to claim 37, wherein said device comprises at least one prism including said at least one sector, and wherein each of face of said plurality of faces ~~are formed by~~ includes a pyramidal depression ~~of the faces on a sector of said at least one prism~~.
39. (Previously Presented) A reference surface device according to claim 37, wherein said mounting element comprises a mounting point adapted to be attached to a feature having a substantially-fixed immobile location relative to the intra-oral scene.
40. (Cancelled)
41. (Currently Amended) A reference surface device according to claim 37, wherein said device comprises at least one substantially ~~plane~~ planar non-polished smooth face.
42. (Currently Amended) A reference surface device according to claim 37, wherein said a mounting element is ~~substantially fixed immobile~~ to said ~~reference surface~~ second end of said sector.
43. (Currently Amended) A reference surface device of claim 37, wherein said ~~reference surface comprises~~ a plurality of faces ~~and wherein said plurality of faces is~~ are spatially distributed in at least one of: two-dimensions or ~~spatially distributed in~~ three-dimensions.
44. (Cancelled)
45. (Currently Amended) A reference surface device according to claim 37, wherein said mounting point is in a predetermined angular orientation relative to at least one of said plurality of faces.

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46. (Previously Presented) A reference surface device according to claim 37, wherein said reference surface device is configured for use in a system for three-dimensional modeling of surface features of an intra-oral scene for a dental application.
47. (Currently Amended) A reference surface device according to claim ~~37~~ 38, wherein said at least one prism comprises a plurality of prisms.
48. (Currently Amended) A reference surface device according to claim 37, wherein each said at least one sector is on a common axis.
49. (Previously Presented) A reference surface device according to claim 37, further comprising at least one of:
- i) an orientation indicium having a predetermined position relative to said face; and
  - ii) a position indicium having a predetermined position relative to said face.
50. (Previously Presented) A reference surface device according to claim 49, comprising at least one orientation indicium and at least one position indicium.
51. (Previously Presented) A reference surface device according to claim 50, comprising a plurality of orientation indicia and a plurality of position indicia.
52. (Currently Amended) A reference surface device according to claim 37, wherein said at least one sector ~~is of~~ includes at least one prism, wherein at least two of said ~~some of said~~ plurality of faces are uniformly distributed in a spatial position ~~and in an angular position~~.
53. (Currently Amended) A reference surface device according to claim 37, wherein ~~said~~ said plurality of faces are distributed assymmetrically in position ~~and in angular orientation angular position~~.

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54. (Currently Amended) A method for determining a position of an intra-oral feature, comprising:

a) introducing a reference surface device ~~according to claim 37~~ into a mouth of a patient, said reference surface device comprising:

at least one sector including a length defining a first end of said at least one sector, a plurality of faces, each face of said plurality of faces at an angular orientation with respect to each adjacent face, the plurality of faces extending along the length of the at least one sector, the at least one sector including oppositely disposed edges which extend from the edges of the outermost faces to a second end of said at least one sector, and wherein said plurality of faces is configured to provide at least one fully intraoral reference surface operative to provide an identifiable positional characteristic; and,

a mounting element in communication with said second end of said at least one sector, wherein said identifiable positional characteristic is at a predetermined three-dimensional spatial position from a mounting point adapted to be attached to a feature having a substantially fixed location relative to said intra-oral scene, said intra-oral scene being configured to provide information for determining the three-dimensional spatial position and orientation of a face on said device relative to the intra-oral scene; and,

b) imaging the intra-oral scene and a plurality of faces thereby capturing a two-dimensional image of the intra-oral scene and at least one of said plurality of faces;

c) processing said two-dimensional image to obtain a three-dimensional data set; and

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- d) stitching said data set of said three dimensional scene with another data set of another three-dimensional scene including said reference surface device thereby determining said position of said intra-oral feature.
55. (Previously Presented) A method according to claim 54, wherein the imaging step comprises providing structured illumination.
56. (Previously Presented) A method according to claim 54, further comprising displaying said structured illumination so as to provide said identifiable positional characteristic.
57. (Previously Presented) A method according to claim 56, wherein said imaging step further comprises providing a cursor over said three-dimensional scene.
58. (Previously Presented) A method according to claim 57, further comprising locating said cursor over said three-dimensional scene.
59. (Previously Presented) A method according to claim 54, further comprising, between step c) and step d) an additional step of identifying said position and orientation indicia on said face in said three-dimensional scene thereby determining a three-dimensional position of said mounting point as the position of the intra-oral feature.
60. (New) The reference surface device according to claim 37, wherein said length defining the first end of said sector includes an arc.
61. (New) The reference surface device according to claim 37, wherein said edges taper inward from the first end to the second end.
62. (New) A reference surface device for use with imaging of an intra-oral scene, the reference surface device comprising:

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a) at least one sector including a plurality of faces, each face of said plurality of faces at an angular orientation on said at least one sector, and wherein said plurality of faces is configured to provide at least one fully intraoral reference surface operative to provide an identifiable positional characteristic; and,

b) a mounting element in communication with said at least one sector, wherein said identifiable positional characteristic is at a predetermined three-dimensional spatial position from a mounting point adapted to be attached to a feature having a substantially fixed location relative to said intra-oral scene, said intra-oral scene being configured to provide information for determining the three-dimensional spatial position and orientation of a face on said device relative to the intra-oral scene; and,

wherein said device comprises at least one prism including said at least one sector, and wherein each of face of said plurality of faces includes a pyramidal depression.

signed                      /Maurice Ernst/

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## **REMARKS**

Reconsideration in view of the foregoing amendments and the following remarks, and entry of this paper, is respectfully requested. Moreover, the applicants have reviewed the Final Office Action of May 6, 2015 (the Final Office Action), and submit that this paper is responsive to all points raised therein.

### **I. Status of the Claims**

Claims 37-62 are pending and are presented for examination.

Claims 37, 38, 42, 43, 45-47 and 51-54 have been amended.

Claims 40 and 44 have been cancelled. Claims 1-36 were cancelled previously.

Claims 60-62 are newly added.

Amendments to claims 37 and 54, are supported, for example, by drawing FIG. 5.

Claims 38, 42, 43, 45-47 and 51-53 were amended for formalities including one or more of proper dependency, spelling, grammar, punctuation, clarity, and consistency with claims from which they depend. As these claim amendments address formalities only, they were not made to avoid any cited art.

New claims 60 and 61 are supported, for example, by drawing FIG. 5.

New claim 62 is supported, for example, by previous claims 37 and 38, and FIG. 5.

### **II. Allowable Subject Matter**

The applicant notes the allowable subject matter of claim 38.

New claim 62 is presented and includes the limitations of allowable previous claim 38 along with the limitations of previous claim 37, from which it is based.



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### **III. Claim Objections**

Claims 37, 39 and 53 were objected to because of informalities at Paragraphs 3-7 of the Final Office Action.

These claims have all been amended in accordance with the Examiner's comments of Paragraphs 3-7 of the Final Office Action. Accordingly, these objections have been cured.

### **IV. Rejections Under 35 USC § 112, Second Paragraph**

Claims 43, 44, 47, 49, 50, and 54-59 were rejected under 35 USC § 112, Second Paragraph, for indefiniteness, as indicated by the Examiner's comments in Paragraphs 9-17 of the Final Office Action.

Initially, claim 44 was cancelled, whereby this rejection is now moot.

Claims 43, 47, 49, 50, and 54-59 have been amended in accordance with the aforementioned Examiner's comments.

Accordingly, these claims are proper 35 UISC § 112, Second Paragraph, whereby withdrawal of these rejections is respectfully requested.

### **V. Rejections Under 35 USC § 102(b)**

Claims 37, 39-54 and 59 were rejected under 35 USC § 102(b) as anticipated by Scharlack, et al. (US Patent No. 6,925,198) (Scharlack '198).

Initially, claims 40 and 44 have been cancelled, whereby these rejections are now moot.

Claim 37 as amended recites features including, "at least one sector including a length defining a first end of said at least one sector, a plurality of faces, each face of said

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plurality of faces at an angular orientation with respect to each adjacent face, the plurality of faces extending along the length of the at least one sector, the at least one sector including oppositely disposed edges which extend from the edges of the outermost faces to a second end of said at least one sector, . . .; and, a mounting element in communication with said second end of said at least one sector. . .” For example, the claimed reference surface device includes at least one sector which is a three dimensional volume with an end including a plurality of adjacent at angular orientations with respect to each other.

Scharlack ‘198 discloses recognition objects of known geometry including, three linked spheres (FIG. 1), a post and head (FIG. 2) and a pyramidal polygon (FIG. 3).

These recognition objects all lack a plurality of angular oriented faces, as recited in claim 37. Additionally, none of the recognition objects of Scharlack ‘198 are equivalent or analogous to the “at least one sector” as these recognition objects lack any “oppositely disposed edges which extend from the edges of the outermost faces to a second end of said at least one sector,” as recited in claim 37, and as such, do not define a volume for the recognition object, as is the case with the recited “at least one sector.”

Based on the discussion above, claim 37 recites structure completely different than that of the recognition objects of Scharlack ‘198. For at least these reasons Scharlack ‘198 fails to meet all of the recitations of claim 37, therefore, does not anticipate claim 37 under 35 USC 102(b). It follows that for at least the same reasons, Scharlack ‘198, does not render claim 37 obvious under 35 USC § 103(a).

Claim 54 has been amended with similar features to that of claim 37. Accordingly, claim 54 is not anticipated under 35 USC § 102(b) and is not rendered obvious under 35 USC § 102(b) by Scharlack ‘198 for at least the same or similar reasons as claim 37.

Since amended independent claims 37 and 54 are neither anticipated under 35 USC § 102(b), nor rendered obvious under 35 USC § 102(b), by Scharlack ‘198 21,

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claims 39, 41-43, 45-53 and 59, dependent from at least one of claims 37 and 59, are also not anticipated or rendered obvious by Scharlack '198, for at least the same reasons. These dependent claims further distinguish the invention over the cited art.

## **VI. Rejections Under 35 USC § 103(a)**

### A. Claims 55 and 56

Claims 55 and 56 were rejected under 35 USC § 103(a) as obvious by Scharlack '198 in view of Ernst, et al. (US Parent Application Publication No. US 2006/0083422 A1) (Ernst '3422).

Claims 55 and 56 depend from claim 54, which has been discussed above. That discussion is applicable here.

Scharlack '198 with respect to claim 54 has been discussed above. That discussion is applicable here.

Ernst '3422 was cited as disclosing structured illumination (claim 55) and structured illumination to provide an identifiable position characteristic (claim 56). However, Ernst '3422 fails to disclose the structure of the recited reference surface device, which is also not disclosed in Scharlack '198.

Accordingly, any addition of Ernst '3422 to Scharlack '198 remains short of all of the recited features of claim 54. For at least this reason, the proposed combination of Scharlack '198 and Ernst '3422 does not render claim 54 obvious under 35 USC § 103(a).

Since amended independent claim 54 is not rendered obvious, under 35 USC § 103(a), by Scharlack '198 and Ernst '3422, for the reasons presented above, claims 55 and 56, dependent from claim 54, are also not rendered obvious under 35 USC § 103(a), by this combination of references, for at least the same reasons. These dependent claims further distinguish the invention over the cited art.

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B. Claims 57 and 58

Claims 57 and 58 were rejected under 35 USC § 103(a) as obvious by Scharlack '198 in view of Ernst '3422, in further view of Boland, et al. (US Parent Application Publication No. US 2003/0012423 A1) (Boland '2423).

Claims 57 and 58 depend from claim 54, which has been discussed above. That discussion is applicable here.

Scharlack '198 and Ernst '3422, with respect to claim 54, has been discussed above. That discussion is applicable here.

Boland '2423 was cited as disclosing a cursor over a three dimensional scene. However, this three dimensional scene is used in constructing a dental model. Boland '2423 fails to disclose the structure of the recited reference surface device, which is also not disclosed in Scharlack '198.

Accordingly, any addition of Boland '2423 to Scharlack '198 and Ernst '3422 remains short of all of the recited features of claim 54. For at least this reason, the proposed combination of Scharlack '198 and Ernst '3422, with Boland '2423, does not render claim 54 obvious under 35 USC § 103(a).

Since amended independent claim 54 is not rendered obvious, under 35 USC § 103(a), by Scharlack '198, Ernst '3422 and Boland '2324, for the reasons presented above, claims 58 and 59, dependent from claim 54, are also not rendered obvious under 35 USC § 103(a), by this combination of references, for at least the same reasons. These dependent claims further distinguish the invention over the cited art.

**VII. Conclusion**

Should the Examiner have any question or comment as to the form, content, or entry of this paper, the Examiner is requested to contact the undersigned at the e-mail and

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telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Entry of this paper and allowance of all pending claims, 37-39, 41-43 and 45-62, is respectfully requested.

The applicant believes that other than a fee for one additional independent claim, there are not any other fees currently due. These fees, and any other fees associated with this paper, may be charged to Deposit Account No. \_\_\_\_\_.

During the pendency of this application, the Commissioner for Patents is hereby authorized to charge payment of any fees necessary for the prosecution of this patent application, any filing fees for presentation of extra claims under 37 CFR § 1.16, any patent application processing fees under 37 CFR § 1.17, any extensions of time, or credit any overpayment to Deposit Account No. \_\_\_\_\_.

The Commissioner for Patents is hereby authorized to treat any concurrent or future reply, requiring a petition for extension of time under 37 CFR § 1.136 for its timely submission, as incorporating a petition for extension of time for the appropriate length of time if not submitted with the reply.

signed

/Maurice Ernst/

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**Authorization for Email Communication**

As per MPEP 502.03, recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file. Email contact information is listed below.

Respectfully submitted,

Date: August 6, 2015

By /Maurice Ernst/

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